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EXAMINER

SIANGCHIN, KEVIN

ART UNIT PAPER NUMBER

2623

DATE MAILED: 02/18/2004

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/809,612

Applicant(s)

MUNSELL, WILLIAM PAUL, JR.

Examiner

Kevin Siangchin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 2 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1 and 2 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

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Detailed Action

Drawings

Objections

1. The submitted drawings (Figures 1-2 on page 2 of the specification) should have been filed on a separate sheet(s).

Specification

Objections

2. The specification is lacking section headings, a Description of the Drawings and a Detailed Description of the Invention as per C.F.R § 1.71. The following are USPTO guidelines for the order and content of the specification. Refer also to the attached Appendix.

The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant's use.

Arrangement of the Specification

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. Each of the lettered items should appear in upper case, without underlining or bold type, as a section heading. If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

- (a) TITLE OF THE INVENTION.
- (b) CROSS-REFERENCE TO RELATED APPLICATIONS.
- (c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.
- (d) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC (See 37 CFR 1.52(e)(5) and MPEP 608.05. Computer program listings (37 CFR 1.96(c)), "Sequence Listings" (37 CFR 1.821(c)), and tables having more than 50 pages of text are permitted to be submitted on compact discs.) or REFERENCE TO A "MICROFICHE APPENDIX" (See MPEP § 608.05(a). "Microfiche Appendices" were accepted by the Office until March 1, 2001.)
- (e) BACKGROUND OF THE INVENTION.
 - (1) Field of the Invention.
 - (2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98.
- (f) BRIEF SUMMARY OF THE INVENTION.
- (g) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).
- (h) DETAILED DESCRIPTION OF THE INVENTION.
- (i) CLAIM OR CLAIMS (commencing on a separate sheet).
- (j) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).
- (k) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).

Content of Specification

- (a) *Title of the Invention:* See 37 CFR 1.72(a) and MPEP § 606. The title of the invention should be placed at the top of the first page of the specification unless the title is provided in an application data sheet. The title of the invention should be

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brief but technically accurate and descriptive, preferably from two to seven words may not contain more than 500 characters.

- (b) *Cross-References to Related Applications*: See 37 CFR 1.78 and MPEP § 201.11.
- (c) *Statement Regarding Federally Sponsored Research and Development*: See MPEP § 310.
- (d) *Incorporation-By-Reference Of Material Submitted On a Compact Disc*: The specification is required to include an incorporation-by-reference of electronic documents that are to become part of the permanent United States Patent and Trademark Office records in the file of a patent application. See 37 CFR 1.52(e) and MPEP § 608.05. Computer program listings (37 CFR 1.96(c)), "Sequence Listings" (37 CFR 1.821(c)), and tables having more than 50 pages of text were permitted as electronic documents on compact discs beginning on September 8, 2000.

Or alternatively, *Reference to a "Microfiche Appendix"*: See MPEP § 608.05(a). "Microfiche Appendices" were accepted by the Office until March 1, 2001.
- (e) *Background of the Invention*: See MPEP § 608.01(c). The specification should set forth the Background of the Invention in two parts:
 - (1) *Field of the Invention*: A statement of the field of art to which the invention pertains. This statement may include a paraphrasing of the applicable U.S. patent classification definitions of the subject matter of the claimed invention. This item may also be titled "Technical Field."
 - (2) *Description of the Related Art including information disclosed under 37 CFR 1.97 and 37 CFR 1.98*: A description of the related art known to the applicant and including, if applicable, references to specific related art and problems involved in the prior art which are solved by the applicant's invention. This item may also be titled "Background Art."
- (f) *Brief Summary of the Invention*: See MPEP § 608.01(d). A brief summary or general statement of the invention as set forth in 37 CFR 1.73. The summary is separate and distinct from the abstract and is directed toward the invention rather than the disclosure as a whole. The summary may point out the advantages of the invention or how it solves problems previously existent in the prior art (and preferably indicated in the Background of the Invention). In chemical cases it should point out in general terms the utility of the invention. If possible, the nature and gist of the invention or the inventive concept should be set forth. Objects of the invention should be treated briefly and only to the extent that they contribute to an understanding of the invention.
- (g) *Brief Description of the Several Views of the Drawing(s)*: See MPEP § 608.01(f). A reference to and brief description of the drawing(s) as set forth in 37 CFR 1.74.
- (h) *Detailed Description of the Invention*: See MPEP § 608.01(g). A description of the preferred embodiment(s) of the invention as required in 37 CFR 1.71. The description should be as short and specific as is necessary to describe the invention adequately and accurately. Where elements or groups of elements, compounds, and processes, which are conventional and generally widely known in the field of the invention described and their exact nature or type is not necessary for an understanding and use of the invention by a person skilled in the art, they should not be described in detail. However, where particularly complicated subject matter is involved or where the elements, compounds, or processes may not be commonly or widely known in the field, the specification should refer to another patent or readily available publication which adequately describes the subject matter.
- (i) *Claim or Claims*: See 37 CFR 1.75 and MPEP § 608.01(m). The claim or claims must commence on separate sheet or electronic page (37 CFR 1.52(b)(3)). Where a claim sets forth a plurality of elements or steps, each element or step of the claim should be separated by a line indentation. There may be plural indentations to further segregate subcombinations or related steps. See 37 CFR 1.75 and MPEP § 608.01(i)-(p).
- (j) *Abstract of the Disclosure*: See MPEP § 608.01(f). A brief narrative of the disclosure as a whole in a single paragraph of 150 words or less commencing on a separate sheet following the claims. In an international application which has entered the national stage (37 CFR 1.491(b)), the applicant need not submit an abstract commencing on a separate sheet if an abstract was published with the international application under PCT Article 21. The abstract that appears on the cover page of the pamphlet published by the International Bureau (IB) of the World Intellectual Property Organization (WIPO) is the abstract that will be used by the USPTO. See MPEP § 1893.03(e).
- (k) *Sequence Listing*, See 37 CFR 1.821-1.825 and MPEP §§ 2421-2431. The requirement for a sequence listing applies to all sequences disclosed in a given application, whether the sequences are claimed or not. See MPEP § 2421.02.

3. The disclosure is objected to because of the following informalities.

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- a. Equation (2a) is aligned with equation (11a). At first glance, this may seem to imply that the value on the right-hand side of the equality of (2a) is assigned to I_{cy} of equation (11a). To avoid confusion, group or align the value on the right-hand side of the equality of (2a) with I_{cy}^i , as intended.
- b. The formulas for the pixel moments of inertia (i.e. equations (2) and (2a)) appear to assume unit mass per pixel. The applicant should state this assumption explicitly.

Appropriate correction is required.

Claims

Objections

4. The claims in this application do not commence on a separate sheet or electronic page in accordance with 37 CFR 1.52(b)(3). Appropriate correction is required in response to this action.
5. Claims 1-2 are objected to because of the following informalities..
 - a. *The following is in regard to Claim 1.* Notice, in claim 1, that items (A) and (B) contain periods, thus demarcating these items as separate sentences. A semi-colon (;) or comma should punctuate these items and the claim should be terminated with a period.
 - b. *The following is in regard to Claim 2.* Notice that the claim consists of two sentences. This claim may be divided into two separate claims, where the latter sentence constitutes a dependant claim, depending on the claim formed by the former. In order to overcome this rejection, these claims could be constructed as follows:

(Claim 2): A method as in claim 1, where there is more than one preferred color and each different color represents a different material and the whole forms a composite structure, and parallel sets of engineering equations are used to evaluate each different material separately.

Claim 2, as submitted by the applicant, will be treated, henceforth in this document, as a single claim, the language of which incorporates the subject matter claimed in both sentences of claim 2.

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Appropriate correction is required.

Rejections Under U.S.C. § 112 (2)

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1 and 2 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

8. *The following is in regard to Claim 1.* Item (B) of claim 1 refers to "Querying the image file". It is not clear as to what image file the applicant is referring. It is assumed in the remainder of this document that, in item (B) of claim 1, the applicant intended to mean, "querying the image".

9. In item (E) of claim 1, the phrase "etc." renders the claim indefinite because the claim includes elements not actually disclosed (those encompassed by "etc."), thereby rendering the scope of the claim unascertainable. See MPEP § 2173.05(d).

10. *The following is in regard to Claim 2.* The applicant refers to *sets of engineering equations* in claim 2. It is unclear from the language of claim 2 as to what engineering equations the applicant is referring. It is assumed, hereinafter, that the applicant is referring to the standard engineering formulations adapted for uses with the arranged data (as per claim 1), the arranged data corresponding to the different materials of claim 2.

11. Claim 2 recites, "[p]arallel sets of engineering equations may be used to evaluate each different material separately". It is unclear, even in light of the specification, as to what is meant by the applicant's usage of the word *parallel*. In the context in which the word *parallel* is used, the claim may be interpreted as: A method as in claim 1, wherein there is more than one preferred color and each different color represents a different material, the totality of these colors forming a composite structure, and the set of standard engineering formulations may be used to evaluate each of the said materials, in parallel (as in parallel processing). The word *parallel* can also be interpreted to mean *analogous*. In this case, distinguishing the equations, as such, is unnecessary because it would be clear from claim 2, as it is interpreted above, that said standard engineering formulations are applied to each different material

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separately. Since the applicant discloses nothing relating to parallel processing, it will be assumed for the remainder that the applicant intended the latter interpretation of the word parallel.

Rejections Under U.S.C. § 112 (1)

12. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

13. Claims 1-2 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

14. 35 U.S.C. 112, first paragraph, requires the specification to be written in "full, clear, concise, and exact terms." The specification is replete with terms which are not clear, concise and exact. The specification should be revised carefully in order to comply with 35 U.S.C. 112, first paragraph. The following items of the specification are unclear, thereby, rendering the specification non-enabling.

- a. The formulas for the pixel moments of inertia (i.e. equations (2) and (2a)) are contrary to accepted formulas for moments of inertia. In particular, the applicant will notice that these formulas result in moments of inertia, $I \propto r^4$, where r is some radial distance. The moment of inertia for a set of discrete masses is typically: $I = \sum_i m_i r_i^2$, where r_i is the radial distance of the i -th element with respect to the centroid and m_i is the mass of the i -th element.
- b. The units (in^4) the applicant uses for moment of inertia (e.g. line 24 on page 2 of the disclosure) are incorrect. An example of a correct unit for moment of inertia is $\text{mass} \times \text{distance}^2$.
- c. Equation (11a) does not seem to account for the aggregate mass of the shape composed of the set of pixels (i.e. the aggregate shape).

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15. *The following is in regard to Claim 1.* The applicant fails to disclose, in sufficient detail, the following aspects of claim 1.

- B. Querying the image file for the x,y coordinated of preferred color pixels and image resolution;
- C. Counting the number of preferred color pixels;
- D. Arranging the data;
- E. Applying standard engineering formulations adapted for use with the arranged data to derive the desired section properties.

In particular, with regard to items (B)-(E) above, the specification fails to disclose the counting of preferred color pixels, how the image or image file is queried for x,y coordinates of preferred color pixels, how the image file or image is queried for the image resolution, how the data is arranged, how the standard engineering formulations are adapted for use with the arranged data, and how these adapted engineering formulations are used to derive the sectional area, radii of gyration, principal axes, products of inertia, and plastic section moduli. Moreover, the specification fails to disclose, in detail sufficient detail as to enable one of ordinary skill in the art to reproduce the claimed invention, how section properties for a mechanical element are approximated from its representation(s) as a digital image(s).

16. *The following is in regard to Claim 2.* The applicant fails to disclose, in detail sufficient detail as to enable one of ordinary skill in the art to reproduce the claimed invention, the following aspects of claim 2: (a) composite structures formed from materials, each of which is represented by different colors; and (b) the manner in which the standard engineering formulations are used to evaluate these materials.

Rejections Under U.S.C. § 102 (b)

17. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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18. Claims 1-2 are rejected under 35 U.S.C. 102(b) as being anticipated by SOFiPLUS™ CAD System for Planning and Statics by SOFiSTiK AG of Munich, Germany.

19. According to SOFiSTiK AG, SOFiPLUS can handle all materials supported by SOFiSTiK structural analysis programs. The cross section of beams and supports can be defined as a circle, torus, slab cross-section, rectangle or slab beam, arbitrary cross-sectional values or as a steel section or tube. The user easily enters and edits the properties of the materials (from static properties and strength to bedding, hydraulic properties, temperature properties and working lines) and the cross-sections using dialogues directly under AutoCAD™ (by AutoDesk, Inc. San Rafael, California). Refer to the SOFiPLUS Manual. These features conform to claims 1 and 2.

Rejections Under U.S.C. § 103 (a)

20. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

21. Claims 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Arakawa (U.S. Patent 4,766,556), in view of Britvec (U.S. Patent 4,646,504).

22. *The following is in regard to Claim 1.* Arakawa discloses a method generating a cross-section of a three-dimensional object and deriving mass properties (Arakawa column 4, lines 66-68) attributed to that section. The method comprises the following steps.

- a. Querying the image for pixels that constitute the cross-section (i.e. preferred color pixels). Again, refer to Arakawa column 8, lines 3-42. The image in this case is the contents of the frame buffer (e.g. Arakawa Fig.13, reference number 26) or, correspondingly, the picture buffer (Arakawa column 4, lines 33-39). Note that the pixels have an associated color, as indicated by Arakawa (Arakawa column 8, lines 54-67). Also note that, while Arakawa does not directly obtain the

resolution of the image, it can be assumed, given the structure of the system on which, Arakawa's method is executed (Arakawa Fig. 13), that an image resolution – that is, the resolution of the image data resident in the frame buffer – is present or prescribed (e.g. by the user) and is known during execution.

- b. Creating a digital image of the cross-section in question. See Arakawa column 8, lines 3-42.
- c. Arranging the data. Data is arranged, for example, according to the picture buffer (Arakawa, Fig.4).
- d. Applying standard engineering formulations adapted for use with the arranged data to derive the desired section properties. See Arakawa column 6, lines 67-68 to column 8, lines 1-2.

The sectional mass properties derived according to the method Arakawa include, moment of inertia and volume. It should be clear that the volume calculation implicitly involves the calculation of area. While Arakawa shows the derivation of the moment of inertia and area (albeit implicitly), Arakawa does not derive the following sectional mass properties: radius of gyration, product of inertia, principal axes, polar moment of inertia, polar radius of gyration, and plastic section modulus. However, knowledge of these properties is often desired for mechanical objects. This is evident, for example, from the teachings of Britvec. The analysis described therein is shown to be applicable to structural members having a slenderness ratio (i.e. the ratio of length to *radius of gyration* – Britvec column 10, lines 30-35). The analysis further includes the calculation of the cross-sectional *moment of inertia* (e.g. equation 1 in column 10 of Britvec). In addition, Britvec's analysis includes the derivation of the *plastic modulus* from an observed stress-strain diagram for the material of the structural member being analyzed (Britvec, equation 31 in column 34 and column 39, lines 1-2). While these teachings are related to a mechanical analysis of the structural member, as opposed to an automated approximate analysis based on a discrete conceptual approximation (as in Arakawa) of the member, Britvec nonetheless illustrates the desirability of knowing material parameters such as the plastic modulus, radius of gyration, and moment of inertia while analyzing or approximating such mechanical elements. Given this and the motivation to improve the capabilities of the mass-properties operations performed in Arakawa's method, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to extend the mass-properties operations performed in Arakawa's method to further derive the plastic modulus and radius of gyration of the cross-section obtained by that method. Furthermore, given that the

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interchangeability of the Cartesian coordinate system and the polar (in \mathcal{R}^2) and the spherical and cylindrical coordinate systems (in \mathcal{R}^3) and the amenability of the latter three coordinate systems to rotating physical systems, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to additionally use these coordinate systems in the extended mass-properties operations. Extending the mass-operations of Arakawa, in the manner just described, would yield a method that conforms to claim 1 of the applicant.

23. Claims 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Arakawa (U.S. Patent 4,766,556), in view of Britvec (U.S. Patent 4,646,504), in further view of Jefferson (U.S. Patent 5,627,554).

24. *The following is in regard to Claim 2.* As shown above, with respect to claim 1, the method taught by Arakawa can be extended in a straightforward manner to conform to claim 1. Arakawa further show the applicability of such a method to multiple objects. See Arakawa column 2, lines 35-40. Also notice that the subscript i found in the discussions relating to the mass-properties operations (Arakawa column 6, lines 67-68 to column 8, lines 1-2) and the cross-sectioning operations (Arakawa column 8, lines 3-42) corresponds the i^{th} object of a multitude of objects (e.g. implied in Arakawa column 6, line 1). Conceptually, since Arakawa does not constrain these objects in any way, this multitude of objects can collectively constitute a composite structure, where each object is a different material. However, Arakawa does not explicitly indicate that different materials should be represented by a respectively different color.

25. Systems, such as CAD/CAM systems, are known to differentiate objects having conceptually different properties with different colors. Jefferson, for example, shows the "color coding" of different parts. See Jefferson, column 7, lines 29-45. Clearly, differentiating parts in this manner advantageously provides the user with visual cues as to where the boundaries of different parts (consisting of conceptually different materials) begin and end. This facilitates the interaction with and manipulation of these constituent parts and/or the composite structure. Given the advantage of "color coding" different constituent parts of a composite structure, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to employ a "color coding" scheme in the method taught by Arakawa and extended, in the manner shown above. In doing so, one would obtain a method capable of cross-sectioning a multitude of objects having different colors, where these objects may conceptually

constitute a composite structure, and deriving any one of the set of material properties discussed above to each of the obtained cross-sections. Such a method would conform to claim 2.

Citation of Relevant Prior Art

26. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

27. Each of the following can address all limitations of the claims, except for the derivations of all the specific sectional material properties: U.S. Patent 6,473,079 (Kacyra et al., Integrated System for Quickly and Accurately Imaging and Modeling Three-dimensional Objects) and U.S. Patent 5,113,490 (Winget, Method for Forming a Computer Model from an Intersection of a Cutting Surface with a Bounded Volume)

28. U.S. Patent 4,497,453 (Megahed et al., *Method and Apparatus for Detecting and Visualizing Interferences Between Solids*) is pertinent to items (A)-(D) of claim 1 and addresses the limitations of claim 2. Megahed does not suggest to derive sectional parameters such as those listed in applicant's claim 1. U.S. Patent 4,809,201 (Keklak, *Graphic Display Region Defining Technique*), however, suggests deriving sectional parameters, some of which are listed in applicant's claim 1, and provides a general motivation for doing so.

29. U.S. Patent 5,815,394 (Adeli et al., *Method and Apparatus for Efficient Design Automation and Optimization, and Structure Produced Thereby*) discloses a computational model that obtains cross-sections of structural elements and derives most of the applicant's listed sectional parameters for these sections. However, being a computational model, neither it, nor the derived cross-sections, requires display (although it would be straightforward to do so).

30. It should also be noted that several software products and CAD plugins are currently available that preprocess or postprocess data CAD object data in a manner similar to the applicant's claimed methods. As mentioned above, one such software package is SOFiPLUS™ by SOFiSTiK™ of Munich, Germany. Other SOFiSTiK documentation establishes the similarity of the SOFiPLUS system with the applicant's claimed methods.

Appendix

1. If applicant continues to prosecute the application, revision of the specification and claims to present the application in proper form may be required. While an application can be amended to make it clearly understandable, no subject matter (new matter) can be added that was not disclosed in the application as originally filed.
2. Following are the copies of § 37 CFR 1.71 (Detailed description and specification of the invention), § 37 CFR 1.75 (Claims), § 37 CFR 1.111 (Reply by applicant or patent owner to a non-final Office action), § 37 CFR 1.112 (Reconsideration before final action), § 37 CFR 1.113 (Final rejection or action), § 37 CFR 1.121 (Manners of Making Amendments in applications), § 37 CFR 1.125 (Substitute specification), and § 37 CFR 1.126 (Numbering of Claims) are provided below regarding the proper format and contents of an application and its amendments:
3. Following these rules are copies of § 37 C.F.R 1.81-1.85 regarding the proper content of drawings submitted with an application.

§ 1.71 Detailed description and specification of the invention.

- (a) The specification must include a written description of the invention or discovery and of the manner and process of making and using the same, and is required to be in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which the invention or discovery appertains, or with which it is most nearly connected, to make and use the same.
- (b) The specification must set forth the precise invention for which a patent is solicited, in such manner as to distinguish it from other inventions and from what is old. It must describe completely a specific embodiment of the process, machine, manufacture, composition of matter or improvement invented, and must explain the mode of operation or principle whenever applicable. The best mode contemplated by the inventor of carrying out his invention must be set forth.
- (c) In the case of an improvement, the specification must particularly point out the part or parts of the process, machine, manufacture, or composition of matter to which the improvement relates, and the description should be confined to the specific improvement and to such parts as necessarily cooperate with it or as may be necessary to a complete understanding or description of it.
- (d) A copyright or mask work notice may be placed in a design or utility patent application adjacent to copyright and mask work material contained therein. The notice may appear at any appropriate portion of the patent application disclosure. For notices in drawings, see § 1.84(s). The content of the notice must be limited to only those elements provided for by law. For example, "©1983 John Doe" (17 U.S.C. 401) and "*M* John Doe" (17 U.S.C. 909) would be properly limited and, under current statutes, legally sufficient notices of copyright and mask

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work, respectively. Inclusion of a copyright or mask work notice will be permitted only if the authorization language set forth in paragraph (e) of this section is included at the beginning (preferably as the first paragraph) of the specification.

(e) The authorization shall read as follows:

A portion of the disclosure of this patent document contains material which is subject to (copyright or mask work) protection. The (copyright or mask work) owner has no objection to the facsimile reproduction by any- one of the patent document or the patent disclosure, as it appears in the Patent and Trademark Office patent file or records, but otherwise reserves all (copyright or mask work) rights whatsoever.

[paras. (d) and (e), 53 FR 47808, Nov. 28, 1988, effective Jan. 1, 1989; para. (d), 58 FR 38719, July 20, 1993, effective Oct. 1, 1993]

§ 1.75 Claim(s)

(a) The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.

(b) More than one claim may be presented provided they differ substantially from each other and are not unduly multiplied.

(c) One or more claims may be presented in dependent form, referring back to and further limiting another claim or claims in the same application. Any dependent claim which refers to more than one other claim ("multiple dependent claim") shall refer to such other claims in the alternative only. A multiple dependent claim shall not serve as a basis for any other multiple dependent claim. For fee calculation purposes under § 1.16, a multiple dependent claim will be considered to be that number of claims to which direct reference is made therein. For fee calculation purposes, also, any claim depending from a multiple dependent claim will be considered to be that number of claims to which direct reference is made in that multiple dependent claim. In addition to the other filing fees, any original application which is filed with, or is amended to include, multiple dependent claims must have paid therein the fee set forth in § 1.16(d). Claims in dependent form shall be construed to include all the limitations of the claim incorporated by reference into the dependent claim. A multiple dependent claim shall be construed to incorporate by reference all the limitations of each of the particular claims in relation to which it is being considered.

(d) (1) The claim or claims must conform to the invention as set forth in the remainder of the specification and the terms and phrases used in the claims must find clear support or antecedent basis in the description so that the meaning of the terms in the claims may be ascertainable by reference to the description. (See § 1.58(a)).

(2) See § 1.141 to 1.146 as to claiming different inventions in one application.

(e) Where the nature of the case admits, as in the case of an improvement, any independent claim should contain in the following order:

- (1) A preamble comprising a general description of all the elements or steps of the claimed combination which are conventional or known,
 - (2) A phrase such as "wherein the improvement comprises," and
 - (3) Those elements, steps, and/or relationships which constitute that portion of the claimed combination which the applicant considers as the new or improved portion.
- (f) If there are several claims, they shall be numbered consecutively in Arabic numerals.
- (g) The least restrictive claim should be presented as claim number 1, and all dependent claims should be grouped together with the claim or claims to which they refer to the extent practicable.
- (h) The claim or claims must commence on a separate sheet.
- (i) Where a claim sets forth a plurality of elements or steps, each element or step of the claim should be separated by a line indentation.

[31 FR 12922, Oct. 4, 1966; 36 FR 12690, July 3, 1971; 37 FR 21995, Oct. 18, 1972; 43 FR 4015, Jan. 31, 1978; para. (c), 47 FR 41276, Sept. 17, 1982, effective Oct. 1, 1982; para. (g) amended, paras. (h) and (i) added, 61 FR 42790, Aug. 19, 1996, effective Sept. 23, 1996]

§ 1.111 Reply by applicant or patent owner to a non-final Office action.

- (a) (1) If the Office action after the first examination (§ 1.104) is adverse in any respect, the applicant or patent owner, if he or she persists in his or her application for a patent or reexamination proceeding, must reply and request reconsideration or further examination, with or without amendment. See §§ 1.135 and 1.136 for time for reply to avoid abandonment.
- (2) A second (or subsequent) supplemental reply will be entered unless disapproved by the Commissioner. A second (or subsequent) supplemental reply may be disapproved if the second (or subsequent) supplemental reply unduly interferes with an Office action being prepared in response to the previous reply. Factors that will be considered in disapproving a second (or subsequent) supplemental reply include:
- (i) The state of preparation of an Office action responsive to the previous reply as of the date of receipt (§ 1.6) of the second (or subsequent) supplemental reply by the Office; and
 - (ii) The nature of any changes to the specification or claims that would result from entry of the second (or subsequent) supplemental reply.
- (b) In order to be entitled to reconsideration or further examination, the applicant or patent owner must reply to the Office action. The reply by the applicant or patent owner must be reduced to a writing which distinctly and specifically points out the supposed errors in the examiner's action and must reply to every ground of objection and rejection in the prior Office action. The reply must present arguments pointing out the specific distinctions believed to render the claims, including any newly presented claims, patentable over any applied references. If the reply is with respect to an application, a request may be made that objections or requirements as to form not necessary to further consideration of the claims be held in abeyance until allowable subject matter is indicated. The applicant's or

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patent owner's reply must appear throughout to be a bona fide attempt to advance the application or the reexamination proceeding to final action. A general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references does not comply with the requirements of this section.

(c) In amending in reply to a rejection of claims in an application or patent under reexamination, the applicant or patent owner must clearly point out the patentable novelty which he or she thinks the claims present in view of the state of the art disclosed by the references cited or the objections made. The applicant or patent owner must also show how the amendments avoid such references or objections.

[46 FR 29182, May 29, 1981; para. (b) revised, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997; paras. (a) and (c) revised, 65 FR 54604, Sept. 8, 2000, effective Nov. 7, 2000]

§ 1.112 Reconsideration before final action.

After reply by applicant or patent owner (§ 1.111 or § 1.945) to a non-final action and any comments by an inter partes reexamination requester (§ 1.947), the application or the patent under reexamination will be reconsidered and again examined. The applicant, or in the case of a reexamination proceeding the patent owner and any third party requester, will be notified if claims are rejected, objections or requirements made, or decisions favorable to patentability are made, in the same manner as after the first examination (§ 1.104). Applicant or patent owner may reply to such Office action in the same manner provided in § 1.111 or § 1.945, with or without amendment, unless such Office action indicates that it is made final (§ 1.113) or an appeal (§ 1.191) has been taken (§ 1.116), or in an inter partes reexamination, that it is an action closing prosecution (§ 1.949) or a right of appeal notice (§ 1.953).

[46 FR 29182, May 29, 1981; revised, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997; revised, 65 FR 54604, Sept. 8, 2000, effective Nov. 7, 2000; revised, 65 FR 76756, Dec. 7, 2000, effective Feb. 5, 2001]

§ 1.113 Final rejection or action.

(a) On the second or any subsequent examination or consideration by the examiner the rejection or other action may be made final, whereupon applicants, or for ex parte reexaminations filed under § 1.510, patent owner's reply is limited to appeal in the case of rejection of any claim (§ 1.191), or to amendment as specified in § 1.114 or § 1.116. Petition may be taken to the Commissioner in the case of objections or requirements not involved in the rejection of any claim (§ 1.181). Reply to a final rejection or action must comply with § 1.114 or paragraph (c) of this section. For final actions in an inter partes reexamination filed under § 1.913, see § 1.953.

(b) In making such final rejection, the examiner shall repeat or state all grounds of rejection then considered applicable to the claims in the application, clearly stating the reasons in support thereof.

(c) Reply to a final rejection or action must include cancellation of, or appeal from the rejection of, each rejected claim. If any claim stands allowed, the reply to a final rejection or action must comply with any requirements or objections as to form.

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[24 FR 10332, Dec. 22, 1959; 46 FR 29182, May 29, 1981; revised, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997; revised, 65 FR 14865, Mar. 20, 2000, effective May 29, 2000 (adopted as final, 65 FR 50092, Aug. 16, 2000); para. (a) revised, 65 FR 76756, Dec. 7, 2000, effective Feb. 5, 2001]

§ 1.121 Manner of making amendments in application.

(a) Amendments in applications, other than reissue applications . Amendments in applications, other than reissue applications, are made by filing a paper, in compliance with § 1.52, directing that specified amendments be made.

(b) Specification other than the claims and listings provided for elsewhere (§ § 1.96 and 1.825) .—

(1) Amendment by instruction to delete, replace, or add a paragraph. Amendments to the specification, other than the claims and listings provided for elsewhere (§§ 1.96 and 1.825), may be made by submitting:

(i) An instruction, which unambiguously identifies the location, to delete one or more paragraphs of the specification, replace a deleted paragraph with one or more replacement paragraphs, or add one or more paragraphs;

(ii) Any replacement or added paragraph(s) in clean form, that is, without markings to indicate the changes that have been made; and

(iii) Another version of any replacement paragraph(s), on one or more pages separate from the amendment, marked up to show all the changes relative to the previous version of the paragraph(s). The changes may be shown by brackets (for deleted matter) or underlining (for added matter), or by any equivalent marking system. A marked up version does not have to be supplied for an added paragraph or a deleted paragraph as it is sufficient to state that a particular paragraph has been added, or deleted.

(2) Amendment by replacement section . If the sections of the specification contain section headings as provided in §§ 1.77(b), 1.154(b), or § 1.163(c), amendments to the specification, other than the claims, may be made by submitting:

(i) A reference to the section heading along with an instruction to delete that section of the specification and to replace such deleted section with a replacement section;

(ii) A replacement section in clean form, that is, without markings to indicate the changes that have been made; and

(iii) Another version of the replacement section, on one or more pages separate from the amendment, marked up to show all changes relative to the previous version of the section. The changes may be shown by brackets (for deleted matter) or underlining (for added matter), or by any equivalent marking system.

(3) Amendment by substitute specification . The specification, other than the claims, may also be amended by submitting:

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- (i) An instruction to replace the specification;
 - (ii) A substitute specification in compliance with § 1.125(b); and
 - (iii) Another version of the substitute specification, separate from the substitute specification, marked up to show all changes relative to the previous version of the specification. The changes may be shown by brackets (for deleted matter), or underlining (for added matter), or by any equivalent marking system.
 - (4) Reinstatement : Deleted matter may be reinstated only by a subsequent amendment presenting the previously deleted matter.
- (c) Claims. —
- (1) Amendment by rewriting, directions to cancel or add . Amendments to a claim must be made by rewriting such claim with all changes (e.g., additions, deletions, modifications) included. The rewriting of a claim (with the same number) will be construed as directing the cancellation of the previous version of that claim. A claim may also be canceled by an instruction.
 - (i) A rewritten or newly added claim must be in clean form, that is, without markings to indicate the changes that have been made. A parenthetical expression should follow the claim number indicating the status of the claim as amended or newly added (e.g., “amended,” “twice amended,” or “new”).
 - (ii) If a claim is amended by rewriting such claim with the same number, the amendment must be accompanied by another version of the rewritten claim, on one or more pages separate from the amendment, marked up to show all the changes relative to the previous version of that claim. A parenthetical expression should follow the claim number indicating the status of the claim, e.g., “amended,” “twice amended,” etc. The parenthetical expression “amended,” “twice amended,” etc. should be the same for both the clean version of the claim under paragraph (c)(1)(i) of this section and the marked up version under this paragraph. The changes may be shown by brackets (for deleted matter) or underlining (for added matter), or by any equivalent marking system. A marked up version does not have to be supplied for an added claim or a canceled claim as it is sufficient to state that a particular claim has been added, or canceled.
 - (2) A claim canceled by amendment (deleted in its entirety) may be reinstated only by a subsequent amendment presenting the claim as a new claim with a new claim number.
 - (3) A clean version of the entire set of pending claims may be submitted in a single amendment paper. Such a submission shall be construed as directing the cancellation of all previous versions of any pending claims. A marked up version is required only for claims being changed by the current amendment (see paragraph (c)(1)(ii) of this section). Any claim not accompanied by a marked up version will constitute an assertion that it has not been changed relative to the immediate prior version.

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(d) Drawings . Application drawings are amended in the following manner: Any change to the application drawings must be submitted on a separate paper showing the proposed changes in red for approval by the examiner. Upon approval by the examiner, new drawings in compliance with § 1.84 including the changes must be filed.

(e) Disclosure consistency . The disclosure must be amended, when required by the Office, to correct inaccuracies of description and definition, and to secure substantial correspondence between the claims, the remainder of the specification, and the drawings.

(f) No new matter . No amendment may introduce new matter into the disclosure of an application.

(g) Exception for examiner's amendments: Changes to the specification, including the claims, of an application made by the Office in an examiner's amendment may be made by specific instructions to insert or delete subject matter set forth in the examiner's amendment by identifying the precise point in the specification or the claim(s) where the insertion or deletion is to be made.

Compliance with paragraphs (b)(1), (b)(2) or (c)(1) of this section is not required.

(h) Amendments in reissue applications. Any amendment to the description and claims in reissue applications must be made in accordance with § 1.173.

(i) Amendments in reexamination proceedings : Any proposed amendment to the description and claims in patents involved in reexamination proceedings in both ex parte reexaminations filed under § 1.510 and inter partes reexaminations filed under § 1.913 must be made in accordance with § 1.530(d)-(j).

(j) Amendments in provisional applications: Amendments in provisional applications are not normally made. If an amendment is made to a provisional application, however, it must comply with the provisions of this section. Any amendments to a provisional application shall be placed in the provisional application file but may not be entered.

[32 FR 13583, Sept. 28, 1967; 46 FR 29183, May 29, 1981; para. (e), 49 FR 555, Jan. 4, 1984, effective Apr. 1, 1984; revised, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997; revised, 65 FR 54604, Sept. 8, 2000, effective Nov. 7, 2000; para. (i) revised, 65 FR 76756, Dec. 7, 2000, effective Feb. 5, 2001]

§ 1.125 Substitute specification.

(a) If the number or nature of the amendments or the legibility of the application papers renders it difficult to consider the application, or to arrange the papers for printing or copying, the Office may require the entire specification, including the claims, or any part thereof, be rewritten.

(b) A substitute specification, excluding the claims, may be filed at any point up to payment of the issue fee if it is accompanied by:

(1) A statement that the substitute specification includes no new matter; and

(2) A marked up version of the substitute specification showing all the changes (including the matter being added to and the matter being deleted from) to the specification of record. Numbering the paragraphs of the specification of record is not considered a change that must be shown pursuant to this paragraph.

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(c) A substitute specification submitted under this section must be submitted in clean form without markings as to amended material. The paragraphs of any substitute specification, other than the claims, should be individually numbered in Arabic numerals so that any amendment to the specification may be made by replacement paragraph in accordance with § 1.121(b)(1).

(d) A substitute specification under this section is not permitted in a reissue application or in a reexamination proceeding.

[48 FR 2712, Jan. 20, 1983, effective Feb. 27, 1983; revised, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997; paras. (b)(2) and (c) revised, 65 FR 54604, Sept. 8, 2000, effective Nov. 7, 2000]

§ 1.126 Numbering of claims.

The original numbering of the claims must be preserved throughout the prosecution. When claims are canceled the remaining claims must not be renumbered. When claims are added, they must be numbered by the applicant consecutively beginning with the number next following the highest numbered claim previously presented (whether entered or not). When the application is ready for allowance, the examiner, if necessary, will renumber the claims consecutively in the order in which they appear or in such order as may have been requested by applicant.

[32 FR 13583, Sept. 28, 1967; revised, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997]

3. It would be of great assistance to the Office if all incoming papers pertaining to a filed application carried the following items:

1. Serial number (checked for accuracy).
2. Group art unit number (copied from filing receipt or most recent Office Action).
3. Filing date.
4. Name of the examiner who prepared the most recent Office action.
5. Title of invention.

§ 1.81 Drawings required in patent application.

(a) The applicant for a patent is required to furnish a drawing of his or her invention where necessary for the understanding of the subject matter sought to be patented; this drawing, or a high quality copy thereof, must be filed with the application. Since corrections are the responsibility of the applicant, the original drawing(s) should be retained by the applicant for any necessary future correction.

(b) Drawings may include illustrations which facilitate an understanding of the invention (for example, flowsheets in cases of processes, and diagrammatic views).

(c) Whenever the nature of the subject matter sought to be patented admits of illustration by a drawing without its being necessary for the understanding of the subject matter and the applicant has not furnished such a drawing, the examiner will require its submission within a time period of not less than two months from the date of the sending of a notice thereof.

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(d) Drawings submitted after the filing date of the application may not be used to overcome any insufficiency of the specification due to lack of an enabling disclosure or otherwise inadequate disclosure therein, or to supplement the original disclosure thereof for the purpose of interpretation of the scope of any claim.

[43 FR 4015, Jan. 31, 1978; para. (a), 53 FR 47809, Nov. 28, 1988, effective Jan. 1, 1989]

§ 1.83 Content of drawing.

(a) The drawing in a nonprovisional application must show every feature of the invention specified in the claims. However, conventional features disclosed in the description and claims, where their detailed illustration is not essential for a proper understanding of the invention, should be illustrated in the drawing in the form of a graphical drawing symbol or a labeled representation (e.g., a labeled rectangular box).

(b) When the invention consists of an improvement on an old machine the drawing must when possible exhibit, in one or more views, the improved portion itself, disconnected from the old structure, and also in another view, so much only of the old structure as will suffice to show the connection of the invention therewith.

(c) Where the drawings in a nonprovisional application do not comply with the requirements of paragraphs (a) and (b) of this section, the examiner shall require such additional illustration within a time period of not less than two months from the date of the sending of a notice thereof. Such corrections are subject to the requirements of § 1.81(d).

[31 FR 12923, Oct. 4, 1966; 43 FR 4015, Jan. 31, 1978; paras. (a) and (c) revised, 60 FR 20195, Apr. 25, 1995, effective June 8, 1995]

§ 1.84 Standards for drawings.

(a) Drawings . There are two acceptable categories for presenting drawings in utility and design patent applications.

(1) Black ink . Black and white drawings are normally required. India ink, or its equivalent that secures solid black lines, must be used for drawings; or

(2) Color. On rare occasions, color drawings may be necessary as the only practical medium by which to disclose the subject matter sought to be patented in a utility or design patent application or the subject matter of a statutory invention registration. The color drawings must be of sufficient quality such that all details in the drawings are reproducible in black and white in the printed patent. Color drawings are not permitted in international applications (see PCT Rule 11.13), or in an application, or copy thereof, submitted under the Office electronic filing system. The Office will accept color drawings in utility or design patent applications and statutory invention registrations only after granting a petition filed under this paragraph explaining why the color drawings are necessary. Any such petition must include the following:

- (i) The fee set forth in § 1.17(h);
- (ii) Three (3) sets of color drawings;

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- (iii) A black and white photocopy that accurately depicts, to the extent possible, the subject matter shown in the color drawing; and
- (iv) An amendment to the specification to insert (unless the specification contains or has been previously amended to contain) the following language as the first paragraph of the brief description of the drawings: The patent or application file contains at least one drawing executed in color. Copies of this patent or patent application publication with color drawing(s) will be provided by the Office upon request and payment of the necessary fee.

(b) Photographs .—

(1) Black and white . Photographs, including photocopies of photographs, are not ordinarily permitted in utility and design patent applications. The Office will accept photographs in utility and design patent applications, however, if photographs are the only practicable medium for illustrating the claimed invention. For example, photographs or photomicrographs of: electrophoresis gels, blots (e.g., immunological, western, Southern, and northern), auto-radiographs, cell cultures (stained and unstained), histological tissue cross sections (stained and unstained), animals, plants, in vivo imaging, thin layer chromatography plates, crystalline structures, and, in a design patent application, ornamental effects, are acceptable. If the subject matter of the application admits of illustration by a drawing, the examiner may require a drawing in place of the photograph. The photographs must be of sufficient quality so that all details in the photographs are reproducible in the printed patent.

(2) Color photographs . Color photographs will be accepted in utility and design patent applications if the conditions for accepting color drawings and black and white photographs have been satisfied. See paragraphs (a)(2) and (b)(1) of this section.

(c) Identification of drawings . Identifying indicia, if provided, should include the title of the invention, inventor's name, and application number, or docket number (if any) if an application number has not been assigned to the application. If this information is provided, it must be placed on the front of each sheet and centered within the top margin.

(d) Graphic forms in drawings . Chemical or mathematical formulae, tables, and waveforms may be submitted as drawings and are subject to the same requirements as drawings. Each chemical or mathematical formula must be labeled as a separate figure, using brackets when necessary, to show that information is properly integrated. Each group of waveforms must be presented as a single figure, using a common vertical axis with time extending along the horizontal axis. Each individual waveform discussed in the specification must be identified with a separate letter designation adjacent to the vertical axis.

(e) Type of paper . Drawings submitted to the Office must be made on paper which is flexible, strong, white, smooth, non-shiny, and durable. All sheets must be reasonably free from cracks, creases, and folds. Only one side of the sheet may be used for the drawing. Each sheet must be reasonably free from erasures and must be free from alterations, overwritings, and interlineations. Photographs must be developed on paper meeting the sheet-size

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requirements of paragraph (f) of this section and the margin requirements of paragraph (g) of this section. See paragraph (b) of this section for other requirements for photographs.

(f) Size of paper . All drawing sheets in an application must be the same size. One of the shorter sides of the sheet is regarded as its top. The size of the sheets on which drawings are made must be:

- (1) 21.0 cm. by 29.7 cm. (DIN size A4), or
- (2) 21.6 cm. by 27.9 cm. (8 1/2 by 11 inches).

(g) Margins . The sheets must not contain frames around the sight (i.e., the usable surface), but should have scan target points (i.e., cross-hairs) printed on two cater-corner margin corners. Each sheet must include a top margin of at least 2.5 cm. (1 inch), a left side margin of at least 2.5 cm. (1 inch), a right side margin of at least 1.5 cm. (5/8 inch), and a bottom margin of at least 1.0 cm. (3/8 inch), thereby leaving a sight no greater than 17.0 cm. by 26.2 cm. on 21.0 cm. By 29.7 cm. (DIN size A4) drawing sheets, and a sight no greater than 17.6 cm. By 24.4 cm. (6 15/16 by 9 5/8 inches) on 21.6 cm. by 27.9 cm. (8 1/2 by 11 inch) drawing sheets.

(h) Views . The drawing must contain as many views as necessary to show the invention. The views may be plan, elevation, section, or perspective views. Detail views of portions of elements, on a larger scale if necessary, may also be used. All views of the drawing must be grouped together and arranged on the sheet(s) without wasting space, preferably in an upright position, clearly separated from one another, and must not be included in the sheets containing the specifications, claims, or abstract. Views must not be connected by projection lines and must not contain center lines. Waveforms of electrical signals may be connected by dashed lines to show the relative timing of the waveforms.

(1) Exploded views . Exploded views, with the separated parts embraced by a bracket, to show the relationship or order of assembly of various parts are permissible. When an exploded view is shown in a figure which is on the same sheet as another figure, the exploded view should be placed in brackets.

(2) Partial views . When necessary, a view of a large machine or device in its entirety may be broken into partial views on a single sheet, or extended over several sheets if there is no loss in facility of understanding the view. Partial views drawn on separate sheets must always be capable of being linked edge to edge so that no partial view contains parts of another partial view. A smaller scale view should be included showing the whole formed by the partial views and indicating the positions of the parts shown. When a portion of a view is enlarged for magnification purposes, the view and the enlarged view must each be labeled as separate views.

(i) Where views on two or more sheets form, in effect, a single complete view, the views on the several sheets must be so arranged that the complete figure can be assembled without concealing any part of any of the views appearing on the various sheets.

(ii) A very long view may be divided into several parts placed one above the other on a single sheet. However, the relationship between the different parts must be clear and unambiguous.

- (3) Sectional views . The plane upon which a sectional view is taken should be indicated on the view from which the section is cut by a broken line. The ends of the broken line should be designated by Arabic or Roman numerals corresponding to the view number of the sectional view, and should have arrows to indicate the direction of sight. Hatching must be used to indicate section portions of an object, and must be made by regularly spaced oblique parallel lines spaced sufficiently apart to enable the lines to be distinguished without difficulty. Hatching should not impede the clear reading of the reference characters and lead lines. If it is not possible to place reference characters outside the hatched area, the hatching may be broken off wherever reference characters are inserted. Hatching must be at a substantial angle to the surrounding axes or principal lines, preferably 45°. A cross section must be set out and drawn to show all of the materials as they are shown in the view from which the cross section was taken. The parts in cross section must show proper material(s) by hatching with regularly spaced parallel oblique strokes, the space between strokes being chosen on the basis of the total area to be hatched. The various parts of a cross section of the same item should be hatched in the same manner and should accurately and graphically indicate the nature of the material(s) that is illustrated in cross section. The hatching of juxtaposed different elements must be angled in a different way. In the case of large areas, hatching may be confined to an edging drawn around the entire inside of the outline of the area to be hatched. Different types of hatching should have different conventional meanings as regards the nature of a material seen in cross section.
- (4) Alternate position . A moved position may be shown by a broken line superimposed upon a suitable view if this can be done without crowding; otherwise, a separate view must be used for this purpose.
- (5) Modified forms . Modified forms of construction must be shown in separate views.
- (i) Arrangement of views . One view must not be placed upon another or within the outline of another. All views on the same sheet should stand in the same direction and, if possible, stand so that they can be read with the sheet held in an upright position. If views wider than the width of the sheet are necessary for the clearest illustration of the invention, the sheet may be turned on its side so that the top of the sheet, with the appropriate top margin to be used as the heading space, is on the right-hand side. Words must appear in a horizontal, left-to-right fashion when the page is either upright or turned so that the top becomes the right side, except for graphs utilizing standard scientific convention to denote the axis of abscissas (of X) and the axis of ordinates (of Y).
- (j) Front page view . The drawing must contain as many views as necessary to show the invention. One of the views should be suitable for inclusion on the front page of the patent application publication and patent as the illustration of the invention. Views must not be connected by projection lines and must not contain center lines. Applicant may suggest a single view (by figure number) for inclusion on the front page of the patent application publication and patent.
- (k) Scale . The scale to which a drawing is made must be large enough to show the mechanism without crowding when the drawing is reduced in size to two-thirds in reproduction. Indications such as "actual size" or "scale 1/2" on the drawings are not permitted since these lose their meaning with reproduction in a different format.

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(l) Character of lines, numbers, and letters. All drawings must be made by a process which will give them satisfactory reproduction characteristics. Every line, number, and letter must be durable, clean, black (except for color drawings), sufficiently dense and dark, and uniformly thick and well-defined. The weight of all lines and letters must be heavy enough to permit adequate reproduction. This requirement applies to all lines however fine, to shading, and to lines representing cut surfaces in sectional views. Lines and strokes of different thicknesses may be used in the same drawing where different thicknesses have a different meaning.

(m) Shading . The use of shading in views is encouraged if it aids in understanding the invention and if it does not reduce legibility. Shading is used to indicate the surface or shape of spherical, cylindrical, and conical elements of an object. Flat parts may also be lightly shaded. Such shading is preferred in the case of parts shown in perspective, but not for cross sections. See paragraph (h)(3) of this section. Spaced lines for shading are preferred. These lines must be thin, as few in number as practicable, and they must contrast with the rest of the drawings. As a substitute for shading, heavy lines on the shade side of objects can be used except where they superimpose on each other or obscure reference characters. Light should come from the upper left corner at an angle of 45°. Surface delineations should preferably be shown by proper shading. Solid black shading areas are not permitted, except when used to represent bar graphs or color.

(n) Symbols . Graphical drawing symbols may be used for conventional elements when appropriate. The elements for which such symbols and labeled representations are used must be adequately identified in the specification. Known devices should be illustrated by symbols which have a universally recognized conventional meaning and are generally accepted in the art. Other symbols which are not universally recognized may be used, subject to approval by the Office, if they are not likely to be confused with existing conventional symbols, and if they are readily identifiable.

(o) Legends . Suitable descriptive legends may be used subject to approval by the Office, or may be required by the examiner where necessary for understanding of the drawing. They should contain as few words as possible.

(p) Numbers, letters, and reference characters.

(1) Reference characters (numerals are preferred), sheet numbers, and view numbers must be plain and legible, and must not be used in association with brackets or inverted commas, or enclosed within outlines, e.g., encircled. They must be oriented in the same direction as the view so as to avoid having to rotate the sheet. Reference characters should be arranged to follow the profile of the object depicted.

(2) The English alphabet must be used for letters, except where another alphabet is customarily used, such as the Greek alphabet to indicate angles, wavelengths, and mathematical formulas.

(3) Numbers, letters, and reference characters must measure at least .32 cm. (1/8 inch) in height. They should not be placed in the drawing so as to interfere with its comprehension. Therefore, they should not cross or mingle with the lines. They should not be placed upon hatched or shaded surfaces. When necessary, such as indicating a surface or cross section, a reference character may be underlined and a blank space may be left in the hatching or shading where the character occurs so that it appears distinct.

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- (4) The same part of an invention appearing in more than one view of the drawing must always be designated by the same reference character, and the same reference character must never be used to designate different parts.
- (5) Reference characters not mentioned in the description shall not appear in the drawings. Reference characters mentioned in the description must appear in the drawings.
- (q) Lead lines . Lead lines are those lines between the reference characters and the details referred to. Such lines may be straight or curved and should be as short as possible. They must originate in the immediate proximity of the reference character and extend to the feature indicated. Lead lines must not cross each other. Lead lines are required for each reference character except for those which indicate the surface or cross section on which they are placed. Such a reference character must be underlined to make it clear that a lead line has not been left out by mistake. Lead lines must be executed in the same way as lines in the drawing. See paragraph (l) of this section.
- (r) Arrows . Arrows may be used at the ends of lines, provided that their meaning is clear, as follows:
- (1) On a lead line, a freestanding arrow to indicate the entire section towards which it points;
 - (2) On a lead line, an arrow touching a line to indicate the surface shown by the line looking along the direction of the arrow; or
 - (3) To show the direction of movement.
- (s) Copyright or Mask Work Notice . A copyright or mask work notice may appear in the drawing, but must be placed within the sight of the drawing immediately below the figure representing the copyright or mask work material and be limited to letters having a print size of 32 cm. to 64 cm. (1/8 to 1/4 inches) high. The content of the notice must be limited to only those elements provided for by law. For example, "©1983 John Doe" (17 U.S.C. 401) and "©M* John Doe" (17 U.S.C. 909) would be properly limited and, under current statutes, legally sufficient notices of copyright and mask work, respectively. Inclusion of a copyright or mask work notice will be permitted only if the authorization language set forth in § 1.71(e) is included at the beginning (preferably as the first paragraph) of the specification.
- (t) Numbering of sheets of drawings . The sheets of drawings should be numbered in consecutive Arabic numerals, starting with 1, within the sight as defined in paragraph (g) of this section. These numbers, if present, must be placed in the middle of the top of the sheet, but not in the margin. The numbers can be placed on the right-hand side if the drawing extends too close to the middle of the top edge of the usable surface. The drawing sheet numbering must be clear and larger than the numbers used as reference characters to avoid confusion. The number of each sheet should be shown by two Arabic numerals placed on either side of an oblique line, with the first being the sheet number and the second being the total number of sheets of drawings, with no other marking.
- (u) Numbering of views.
- (1) The different views must be numbered in consecutive Arabic numerals, starting with 1, independent of the numbering of the sheets and, if possible, in the order in which they appear on the drawing sheet(s). Partial views intended to form one complete view, on one or several sheets, must be identified by the same number followed by a capital letter. View numbers must be preceded by the abbreviation "FIG." Where

only a single view is used in an application to illustrate the claimed invention, it must not be numbered and the abbreviation "FIG." must not appear.

(2) Numbers and letters identifying the views must be simple and clear and must not be used in association with brackets, circles, or inverted commas. The view numbers must be larger than the numbers used for reference characters.

(v) Security markings . Authorized security markings may be placed on the drawings provided they are outside the sight, preferably centered in the top margin.

(w) Corrections . Any corrections on drawings submitted to the Office must be durable and permanent.

(x) Holes . No holes should be made by applicant in the drawing sheets.

(y) Types of drawings . See § 1.152 for design drawings, § 1.165 for plant drawings, and § 1.174 for reissue drawings.

[24 FR 10332, Dec. 22, 1959; 31 FR 12923, Oct. 4, 1966; 36 FR 9775, May 28, 1971; 43 FR 20464, May 11, 1978; 45 FR 73657, Nov. 6, 1980; paras. (a), (b), (i), (j), and (l) amended, paras. (n), (o), and (p) added, 53 FR 47809, Nov. 28, 1988, effective Jan. 1, 1989; revised, 58 FR 38719, July 20, 1993, effective Oct. 1, 1993; paras. (c), (f), (g), and (x) revised, 61 FR 42790, Aug. 19, 1996, effective Sept. 23, 1996; paras. (a)(2)(i), (b), (c) & (g) revised, 62 FR 53131, Oct. 10, 1997, effective Dec. 1, 1997; paras. (a), (b), (c), (j), (k), (o), and (x) revised, and para. (y) added, 65 FR 54604, Sept. 8, 2000, effective Nov. 7, 2000; paras. (a)(2), (e), and (j) revised, 65 FR 57024, Sept. 20, 2000, effective Nov. 29, 2000]

§ 1.85 Corrections to drawings.

(a) A utility or plant application will not be placed on the files for examination until objections to the drawings have been corrected. Except as provided in § 1.215(c), any patent application publication will not include drawings filed after the application has been placed on the files for examination. Unless applicant is otherwise notified in an Office action, objections to the drawings in a utility or plant application will not be held in abeyance, and a request to hold objections to the drawings in abeyance will not be considered a bona fide attempt to advance the application to final action (§ 1.135(c)). If a drawing in a design application meets the requirements of § 1.84(e), (f), and (g) and is suitable for reproduction, but is not otherwise in compliance with § 1.84, the drawing may be admitted for examination.

(b) The Office will not release drawings for purposes of correction. If corrections are necessary, new corrected drawings must be submitted within the time set by the Office.

(c) If a corrected drawing is required or if a drawing does not comply with § 1.84 at the time an application is allowed, the Office may notify the applicant and set a three month period of time from the mail date of the notice of allowability within which the applicant must file a corrected or formal drawing in compliance with § 1.84 to avoid abandonment. This time period is not extendable under § 1.136(a) or § 1.136(b).

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[47 FR 41276, Sept. 17, 1982, effective Oct. 1, 1982; 53 FR 47810, Nov. 28, 1988, effective Jan. 1, 1989; revised, 65 FR 54604, Sept. 8, 2000, effective Nov. 7, 2000; para. (a) revised, 65 FR 57024, Sept. 20, 2000, effective Nov. 29, 2000]

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Siangchin whose telephone number is (703)308-6604. The examiner can normally be reached on 9:00am - 5:30pm, Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703)308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Kevin Siangchin



Examiner
Art Unit 2623



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SUPERVISORY PATENT EXAMINER
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